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RISK ASSESSMENT
FOR
PUBLIC USE OF WAUKEGAN ADDITIONAL SITE #2
(RIFLE RANGE/FISHING PIER ACCESS)

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1.0 INTRODUCTION AND OBJECTIVES

On behalf of Johns Manville International Inc. (JM), the Center for Toxicology and Environmental Health (CTEH®) conducted a baseline risk assessment (RA) for asbestos fibers in air. The objective of the RA is to define the types and extent of public health hazards, if any, associated with possible asbestos emissions from additional site #2 ("site #2") at the Johns Manville Manufacturing Facility located in Waukegan Illinois, in the absence of any action to control or mitigate potential releases. This report considers the health risk posed by potential exposure to asbestos fibers in the air that may be present near site #2. It analyzes site conditions and the potential risks to human health posed by such emissions under exposure conditions considered representative of public use of site #2 and the nearby fishing pier.

To achieve this objective, risk assessment procedures outlined by the United States Environmental Protection Agency (USEPA) are used. This risk assessment is prepared using guidance outlined in Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Volume I Part A (USEPA, 1989) and Part B (USEPA, 1991a), and the Exposure Factors Handbook (USEPA, 1997).

A risk assessment is an evaluation of the probability that a person(s) will experience health problems as a result of exposure to a chemical or agent in soil, water, or air. Risk assessments are typically conducted at USEPA Superfund sites or at state regulated sites as a component of the risk-based closure process to determine what, if any, remedial actions are necessary.

1.1 Background

JM contracted with CTEH to evaluate possible health risks from public use of site #2 and the nearby fishing pier located immediately south of the boundary of the JM property. The fishing pier is east of the CommEd public utility and the former shooting range. Public use of the fishing pier is accessed from site #2. The main public use of site #2 is for fishermen to park and gain access to the fishing pier. Due to concern regarding asbestos fibers being released from asbestos-containing materials (ACM) in soil at site #2, State and Federal agencies are suggesting that some type of remediation be conducted where ACM was identified in soil. Accordingly, the results of this risk assessment can be used to help guide remedial decisions at site #2 on the basis of risk.

2.0 EXPOSURE ASSESSMENT

The purpose of the exposure assessment is to estimate the type and magnitude of asbestos intakes that may result from exposure to asbestos present in air at site #2 and the fishing pier. In the exposure assessment, the pathways by which public users of site #2 and the fishing pier may be exposed to asbestos are identified. When an exposure pathway is determined to be complete, exposure to asbestos fibers is estimated in terms of fiber intake per day. This section of the report reviews potentially complete exposure pathways to asbestos fibers in air and the methods used to assess asbestos exposure resulting from inhalation exposure at site #2 and the fishing pier.

2.1 Public Use of Site #2 (Fishermen)

Based on observations and historical use of site #2 and the fishing pier, adult fishermen were determined to be the most likely receptor population to potential releases of asbestos fibers from ACM in soil near site #2. Thus, for purposes of assessing the long-term health risk posed by site #2, it was conservatively assumed that adult fishermen would receive exposure to asbestos fibers.

2.2 Exposure Pathway Analysis

The USEPA states that an exposure pathway "describes the course a chemical or physical agent takes from the source to the exposed individual. An exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine the significant pathways of human exposure" (USEPA, 1989).

An exposure pathway is composed of four elements:

- A source and mechanism of chemical release,
- A retention or transport medium,
- A point of potential human contact with the contaminated medium, and
- An exposure route at the contact point

An exposure pathway is considered complete if all four elements are present, and incomplete if one or more of these elements is not present. Implicit in a complete

exposure pathway is an estimation of the expected degree of human population contact with asbestos fibers. The results of extensive asbestos monitoring measured before, during, and after remediation of the JM facility indicate non-detectable asbestos fiber concentrations in air near site #2. Thus, under present site conditions, there are no complete exposure pathways for public users of site #2. Nonetheless, for purposes of assessing the potential health risk posed by asbestos in air near site #2, we assumed that a hypothetical air pathway was complete for fishermen who may be using site #2 and the nearby fishing pier.

The extent of exposure of fishermen to asbestos in air will likely be infrequent and episodic. The most frequent exposure is likely to occur during the warmer summer months and in the spring and fall when the ground is not frozen or covered by snow.

Exposure variables and assumptions used to calculate adult fishermen intakes of asbestos fibers in air via inhalation are presented in Table 1. Important variables to be considered in assessing exposure to asbestos in air include the asbestos concentration, inhalation rate, time spent fishing, and number of years fishermen would likely access site #2 and the nearby fishing pier.

The mean time spent (minutes/day) fishing was conservatively obtained from USEPA (1997). The Exposure Factors Handbook lists activity patterns for 87 different activities. Under sports and leisure, USEPA lists the following activities under category 81 (out of doors): hunting, fishing, boating, sailing, canoeing, camping, at the beach, snowmobiling, dune-buggies, gliding, ballooning, flying, excursions, pleasure drives (no destination), rides with the family, and picnicking. For these activities, the 95% upper confidence limit for weekdays is 59.55 minutes/day, on Saturdays, 102.33 minutes/day, and on Sundays, 118.9 minutes/day. Thus, an upper-bound, conservative estimate of time spent in outdoor sports and leisure is about 519 minutes/week. Based on these data, we conservatively assumed fishermen would spend about 8.6 hours/week at site #2 and the fishing pier.

For the number of days per year fishermen may be exposed to asbestos in air, we conservatively assumed an upper bound estimate of 234 days/year. A value of 234 days per year represents the number of days the ground at the site is not frozen or covered by snow. According to National Oceanic and Atmospheric Administration (NOAA) data, the number of days in the year where the average temperature near Waukegan, Illinois is

less than 32 degrees Fahrenheit is 131 days (NOAA, 1999). Thus, 365 days minus 131 days equals 234 days of non-freezing or snow covered ground.

There were no data concerning lifetime exposure days for fishing activities. Thus, we conservatively used the 95th percentile for residence time of 30 years which is the USEPA default exposure duration for the length of time a person resides in a household (USEPA, 1991a).

The inhalation rate recommended for short term exposures during sedentary activities such as fishing is 0.5 m^3/hour (USEPA, 1997). Thus, we conservatively selected 0.5 m^3/hour for our exposure assessment. Thus, the amount of air inhaled while fishing each week is 4.3 m^3 (8.6 hours x 0.5 m^3/hour) or 0.6 m^3/day.

The equations used to calculate inhalation exposure to asbestos fibers in air is presented in Table 2.

2.3 Concentrations of Asbestos in Air Near Site #2 Used in Assessing Exposure

A number of air sampling studies for asbestos fibers in air have been conducted at the JM site (CCJM, 1990, 1991, 1993, 1997; Illinois DNR, 1998; KMA, 1985). These studies were reviewed to determine the concentration of asbestos (as analyzed by Phase Contrast Microscopy or PCM) in air near site #2. Two studies were identified which provide data that can be used to estimate risks to public health near site #2 (CCJM, 1990, 1991). The data from these studies were reviewed to identify which sampling locations best represent exposure conditions near site #2. The data from those stations are summarized below.

Asbestos Sampling Results Near Site #2

Sample Results Near Site #2	Number Detected	Number Analyzed	% Non-detect	Average of detects (f/mL)	Average* Asbestos Concentration (f/mL)
Pre-Remediation	0	18	100.0	NA	0.00375
During Remediation	0	217	100.0	NA	0.00344

*Averaged calculated using ½ the method detection limit
NA – not applicable

Since asbestos samples collected during remediation activities likely represent worst-case exposure conditions because clearing, grading, etc., were disturbing site soil, these sampling data were used to calculate potential exposures for public users of site #2 and the nearby fishing pier. The results of measured air concentrations for asbestos fibers in air near site #2 indicate that asbestos was not detected in over 217 samples collected during site remediation. Nonetheless, in order to estimate hypothetical risks to public users of site #2, the average of ½ the method detection limit was used to calculate lifetime cancer risks.

The absence of detectable airborne asbestos fibers at this site was confirmed in more recent air sampling (Illinois DNR, 1998). During this sampling event, a Weedeater and Ground Sweeper leaf blower were used to purposefully and aggressively agitate the air and surrounding ground surface in order to attempt to collect any asbestos fiber that may be released from ACM in soil and sand into the air. A total of 13 samples were collected along Illinois Beach State Park and one background station, and analyzed for asbestos using Transmission Electron Microscopy (TEM), a method specific for asbestos fibers. No fibers were detected in any sample with a detection limit of <0.005 (f/mL).

2.4 Calculated Exposures to Asbestos Fibers in Air Near Site #2

Fishermen exposures to asbestos fibers can be calculated using the assumptions and equation presented in Tables 1 and 2, respectively, and the asbestos concentrations discussed in Section 2.3. Lifetime average daily exposures to asbestos were calculated assuming that fishermen are exposed to asbestos fibers at the frequency presented in Table 1 for a period of 30 years. The lifetime average daily exposure is used to estimate carcinogenic risk over a 70-year lifetime (25,500 days).

3.0 TOXICITY ASSESSMENT

3.1 Definitions and Explanations of USEPA Asbestos Unit Risk

The USEPA has derived toxicity values for a number of chemicals on the basis of experimental studies in experimental animals or human epidemiological studies. These values are used to assess human health risks resulting from potential chemical exposure.

The slope factor may be defined as an upper-bound estimate of the probability of a carcinogenic response per unit intake of a chemical over a lifetime, whereas, the unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed (in the case of asbestos, f/mL). The USEPA Integrated Risk Information System (IRIS) unit risk for asbestos[1] is 2.3E-1 per f/mL^{-1}. Thus, the units of the unit risk for asbestos are $(fibers/mL)^{-1}$. When multiplied by the lifetime average daily exposure to asbestos fibers in f/mL, a unitless estimate of theoretical lifetime cancer risk is calculated.

[1] The unit risk is based on fiber counts made by phase contrast microscopy (PCM) and should not be applied directly to measurements made by other analytical techniques. The unit risk uses PCM fibers because the measurements made in the occupational environment use this method.

4.0 CHARACTERIZATION OF THEORETICAL LIFETIME CANCER RISKS ASSOCIATED WITH PUBLIC USE OF SITE #2

4.1 Theoretical Cancer Risk

Because there are no complete exposure pathways under present site conditions, there is no current risk to public users of site #2 and the nearby fishing pier. However, the calculated hypothetical lifetime cancer risks resulting from public (fishermen) exposure to asbestos in air near site #2 resulting from daily exposure over a 30-year exposure period was 0.000007 (7 in 1,000,000 or $7x10^{-6}$; Table3). This theoretical lifetime cancer risk is within the range of risks considered acceptable by the USEPA.

With regard to allowable lifetime cancer risk for Superfund sites, the USEPA has stated that:

> "Generally, where the baseline risk assessment indicates that a cumulative site risk to an individual using reasonable maximum exposure assumptions for either current or future land use exceeds the 10^{-4} lifetime excess cancer risk end of the risk range, action under CERCLA is generally warranted at the site." (USEPA, 1991b)
>
> and
>
> "EPA uses the general 10^{-4} to 10^{-6} risk range as a "target range" within which the Agency strives to manage risks as part of a Superfund cleanup. Once a decision has been made to take an action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e., 10^{-6}), although waste management strategies achieving reductions in site risk anywhere within the risk range may be deemed acceptable by the EPA risk manager. Furthermore, the upper boundary of the risk range is not a discrete line at 1×10^{-4}, although EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks. Therefore, in certain cases EPA may consider risk estimates slightly greater than 1×10^{-4} to be protective." (USEPA, 1991b)

5.0 SUMMARY AND CONCLUSIONS

The objective of this report is to define the types and extent of public health hazards, if any, associated with possible asbestos emissions from site #2 at the Johns Manville Manufacturing Facility located in Waukegan, Illinois, in the absence of any action to control or mitigate potential releases. The most likely public user of site #2 and the fishing pier was determined to be an adult fisherman. Site-specific information was used to calculate potential exposure to asbestos fibers by fishermen from site #2.

Past and recent air sampling data in the area of site #2 indicated that asbestos fibers were not detected in over 235 separate samples collected prior to, and during remediation. These data were confirmed during a recent asbestos-containing material (ACM) removal project conducted by the Illinois Department of Natural Resources along Illinois Beach State Park. Samples collected and analyzed for asbestos fibers using TEM found no detectable fibers.

Since risk equals toxicity times exposure, without any exposure, there can be no risk. Thus, potential risks to nearby public users of site #2 and the nearby fishing pier under present site conditions would likely be zero. Nonetheless, for purposes of assessing the hypothetical potential health risk posed by asbestos in air, ½ of the analytical detection limit for asbestos PCM samples collected near site #2 were used in the analyses of risk.

Using USEPA approved risk assessment methods, the calculated lifetime cancer risk associated with hypothetical fishermen exposure to asbestos in air was 7×10^{-6}. This level of lifetime cancer risk is within the USEPA acceptable range of lifetime cancer risk (1×10^{-4} to 1×10^{-6}).

In summary, health risks resulting from public use of site #2 in its present, unremediated condition, are acceptably low.

These exposures were assumed to occur in the absence of any institutional controls such as capping or excavation. Thus, the results of this risk assessment indicate that potential remedial actions for soil at site #2 are not warranted or, at best, should be considered minimal in nature and design.

6.0 REFERENCES

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Table 1
Air Exposure Assumptions

Key to Assumptions

C	Asbestos concentration in air (f/mL)
DIR_{air}	Daily Inhalation rate (m^3/day)
EF	Days exposed per year (days/year)
ED	Years exposed per lifetime (year)
ATc	Days in a lifetime (days)

Exposure Variables

Exposure Parameter	Inhalation Exposures by Fishermen	References
C	0.00344 (f/mL)	average concentration using ½ the method detection limit based on measured site-specific data during worst-case conditions of remediation activities
DIR_{air}	0.6 m^3/day	USEPA, 1997
EF	234 days	Site-specific information (NOAA web page)
ED	30 years	USEPA, 1991a
ATc	25,550 days	USEPA, 1989 (70 years x 365 days/year)

Table 2

Calculation of Lifetime Exposure and Cancer Risks from Inhalation of Asbestos Fibers In Air Near Site #2

Parameter	Equation	Exposure variables
Exposure (E)	$\frac{C \times DIRair \times EF \times ED}{20\,m^3/day \times ATc}$	E = Lifetime average exposure Level (f/mL) C = Concentration of asbestos in air (f/mL) DIRair = Daily Inhalation rate (m^3/day) EF = Exposure frequency (days/year) ED = Exposure duration (years) ATc =Averaging time for carcinogen (period over which exposure is averaged (25,550 days = 70 years x 365 day)
Risk (R)	E x UC	R = Lifetime cancer risk (unitless) E = Lifetime average exposure Level (f/mL) UC = unit risk $(f/mL)^{-1}$

Table 3

Calculated Lifetime Average Exposure and Cancer Risk Associated with Fishing Activities Near Site #2

Chemical	Lifetime Average Exposure (f/mL)	Theoretical Lifetime Cancer Risk
Asbestos	0.00005 or 3E-05	0.000007 or 7E-06